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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/041,558	01/10/2002	Wolfram Burst	52097	2747

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EXAMINER

SINGH, PREM C

ART UNIT PAPER NUMBER

1764

DATE MAILED: 09/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/041,558

Applicant(s)

BURST ET AL.

Examiner

Prem C. Singh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 January 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☒ Claim(s) 14 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Specification

The disclosure is objected to because of the following informalities:

Claim 14 says a process as claimed in claim 12, wherein a fraction which comprises butyl chloride and water and is largely free of perchloroethylene and n-butanol is additionally obtained as lowest boiling fraction. In the drawings, butyl chloride is shown to be the top component.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurata et al (US Patent 4,204,915) in view of Van Winkle (Distillation, McGraw Hill, 1967).

Applicant's invention per claim 1 is about a method of separating a liquid mixture which forms at least one azeotrope by azeotropic distillation with an entrainer which additionally forms a binary and ternary azeotrope with the other components to be separated. The azeotropes have boiling points lower than that of entrainer. The azeotropes are separated into two parts: A, H containing fraction depleted in B and B, H containing fraction depleted in A. At least a part of the auxiliary H is introduced at the top and/or in the upper region of a column for distillation.

Kurata invention (Figure 1) teaches schematically an azeotropic distillation process similar to the one claimed by the applicant's claim 1 which comprises:

- (a) distilling the mixture in a distillation column in the presence of an entrainer which forms an azeotrope with the water in an azeotropic zone of the column;
 - (b) separating the azeotrope as an overhead fraction;
- (Column 6, lines 1-4).

It is to be noted that Kurata invention's water, acetic acid, and butyl acetate are representing components A, B, and H respectively, of the applicant.

Kurata invention mentions that he gets a ternary azeotropic system of acetic acid-water-butyl acetate (Column 4, lines 39-40). Kurata's figure 1 shows that the azeotropes are separated in to two parts: aqueous phase and oil phase. Aqueous phase is rich in water and depleted in butyl acetate, while the oil phase is rich in butyl

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acetate and depleted in water. Kurata invention further teaches that a part of the auxiliary butyl acetate is introduced at the top of the column as reflux to carry out the continuous azeotropic distillation (Column 4, lines 51-53).

Kurata's invention does not disclose that the binary azeotropes have boiling point lower than the entrainer. Van Winkle teaches that (1) the entrainer forms a binary minimum azeotrope boiling at lower temperature than the original, (2) the entrainer forms a ternary minimum azeotrope boiling at a lower temperature than the original (Page 410).

Claim 3 of the applicant says that the mixture to be separated is introduced continuously into the column.

Kurata invention teaches that the azeotropic distillation can be effected either batch wise or continuously (Column 3, lines 12-13).

Claim 6 of the applicant says that the auxiliary entrainer is obtained as bottom product and is recirculated at least partly to the top or into the upper region of the column.

Kurata invention teaches about refluxing a first portion of the entrainer-rich phase into the upper region of the azeotropic zone through a first entrainer feed (Column 6, lines 7-9).

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Claim 7 of the applicant says that A, H containing fraction is taken off at a point above the feed point and B, H containing fraction is taken off at a point below the feed point.

Kurata invention's figure 1 discloses that water, butyl acetate containing fraction is taken off at a point above the feed point and acetic acid, butyl acetate containing fraction is taken off at a point below the feed point.

Claim 8 of the applicant mentions that the mass flow of auxiliary entrainer introduced is from 0.5 to 15 times the mass flow of the mixture to be separated.

Kurata invention teaches that the mass flow of entrainer in the azeotropic distillation is 302.76 Kg/hr (Column 5, line 25) and the feed rate of water-acetic acid mixture is 178.52 Kg/hr (Column 4, line 44). Thus, the ratio of mass flow rate of entrainer and the feed rate is 1.7, which falls within applicant's claim range of 0.5 to 15.

Claim 9 of the applicant says that binary azeotrope AH and/or BH is a heteroazeotrope.

Kurata invention teaches that his system is a heteroazeotrope (Column 2, lines 61-62).

Applicant's claim 10 discusses that the liquid or liquefied AH containing and/or BH containing fraction is subjected to a phase separation to give A-rich or B-rich phase and an H-rich phase is returned to the column.

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Kurata invention's figure 1 shows that the water-butyl acetate fraction is subjected to a phase separation to give water rich phase and butyl acetate rich phase is returned to the column.

Claims 11-15 are rejected as unpatentable over Kurata in view of Begun (US Patent 3,733,218) and further in view of Ohe (Vapor-Liquid Equilibrium Data by S. Ohe, Elsevier Science Publishers, Amsterdam, 1999, #758 and #763,764) and Perry (Chemical Engineers Handbook by Perry and Chilton, Fifth Edition, McGraw Hill, 1973, Page13-39).

The applicant mentions in claim 11 that component A is selected from the group consisting of chlorinated hydrocarbons and monocyclic C₆-C₁₀ aromatics and component B is selected from the group consisting of C₃-C₈ alkanols and the auxiliary H is water.

Kurata invention is not selecting A from chlorinated hydrocarbons and monocyclic aromatics, B from alkanols, and the auxiliary H as water. Begun in his invention describes an azeotrope with perchloroethylene and cyclopentanol (Column 1, lines 69-70). Perchloroethylene is a chlorinated hydrocarbon and cyclopentanol is a C₅ alkanol.

It would have been obvious to one skilled in the art at the time the invention was made to combine the teachings of Kurata and Begun, using Begun's components and substituting water for butyl acetate as the entrainer in the Kurata setup of azeotropic

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distillation. The motive behind this was to replace expensive butyl acetate by cheaper water as the entrainer.

Claim 12 of the applicant mentions that the chlorinated hydrocarbon is perchloroethylene and the alkanol is n-butanol and the mixture optionally further comprises butyl chloride.

Kurata invention does not mention about perchloroethylene and n-butanol. Begun invention discloses perchloroethylene and cyclopentanol. Standard texts and Ohe presents data on relative volatility and vapor-liquid equilibrium of perchloroethylene-n-butanol and butyl chloride-n-butanol azeotropic systems.

It would have been obvious to one skilled in the art at the time the invention was made to combine the teachings of Kurata, Begun, and Ohe to replace cyclopentanol and substitute with n-butanol. The motive behind this was because of the easy availability and cheaper price for butanol as compared to cyclopentanol. The reason for the optional use of butyl chloride along with perchloroethylene was to use a blend of two chlorinated hydrocarbons instead of one to give more flexibility to the process and to show that more than one chlorinated hydrocarbons could be used.

Claim 13 of the applicant mentions a process wherein the liquefied n-butanol/water fraction is subjected to a phase separation to give n-butanol-rich phase and a water-rich phase and the n-butanol-rich phase is separated by distillation into a fraction enriched in n-butanol and a fraction depleted in n-butanol.

Kurata invention teaches about a liquefied water/butyl acetate fraction which is subjected to a phase separation to give water rich phase and a butyl acetate rich phase. It does not mention about phase separation of n-butanol/water fraction and separation of n-butanol rich phase into a fraction enriched in n-butanol and a fraction depleted in n-butanol. Perry teaches in his figure 13-38 that liquefied n-butanol/water feed enters a decanter (phase separator), which operates at a temperature below the boiling point. The butanol-rich phase from the decanter is fed to a stripping column which produces high purity alcohol as the bottom product and an overhead vapor which approaches the azeotropic composition. The aqueous phase is fed to a second stripper which produces butanol free water as a bottom product. Since water is the bottom product, open steam can be used to provide "reboil" vapor. The aqueous column also produces a top vapor which approaches the azeotropic composition. Both overhead vapor streams are condensed in a common condenser and then fed to the decanter along with the fresh feed (Page 13-37 column 2, and Page 13-38Column 1).

It would have been obvious to one skilled in the art at the time the invention was made to modify the teachings of Kurata with Perry invention and thereby obtaining the invention as set forth in claim 13. The motive behind this was because of the fact that n-butanol/water azeotropic separation has more industrial applications than the water/butyl acetate separation.

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The applicant in claim 14 mentions that a fraction which comprises butyl chloride and water and is largely free of perchloroethylene and butanol is additionally obtained as lowest boiling fraction.

Kurata invention does not mention about obtaining butyl chloride and water as the lowest boiling fraction. As mentioned under claim 12, standard texts and Ohe present azeotropic distillation data for the system butyl chloride-n-butanol-water.

It would have been obvious to one skilled in the art at the time the invention was made to combine the teachings of Kurata and Ohe to show that butyl chloride-water could be obtained as the lowest boiling fraction. The motive behind this as explained under claim 12, was to achieve more flexibility for the process and to show that more than one chlorinated hydrocarbons could be used in the azeotropic distillation columns.

The applicant in claim 15 mentions that the auxiliary H further comprises a base.

Kurata invention uses butyl chloride as the auxiliary H. As mentioned under claim 11, one skilled in the art at the time the invention was made, could have combined the teachings of Kurata and Begun and used Begun's components with water substituted for butyl acetate as the entrainer. The motive behind this was to replace an expensive entrainer by a cheaper one. Kurata and Begun do not add a base in the auxiliary.

It would have been obvious to one skilled in the art at the time the invention was made to add a base in the entrainer. The motive behind using a base mixed with water was to reduce the corrosive action of the chlorinated hydrocarbons and increase the life of the equipment.

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Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Berg, US Patent 5,417,813

Sridhar, US Patent 4,652,343

Hanel, DERWENT, 1991-311278.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Prem C. Singh whose telephone number is 571-272-6381. The examiner can normally be reached on MF 6:30-3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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